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10EE62

**Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019**  
**Switchgear and Protection**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting  
at least TWO full questions from each part.**

**PART – A**

- 1 a. With a neat sketch, explain the construction operation and characteristic of HRC fuse. (08 Marks)
- b. What is isolating switch? Mention the types of isolators and explain any one in brief with a neat sketch. (08 Marks)
- c. Define the following:
  - i) Fuse
  - ii) Rated current of the fuse
  - iii) Fusing current
  - iv) Fusing factor of the fuse. (04 Marks)
- 2 a. Explain how the arc is formed and maintained between the contacts of a circuit breaker. What are the different methods of arc quenching? (08 Marks)
- b. Derive an expression for restriking voltage and RRRV in terms of system voltage, inductance, and capacitance. (06 Marks)
- c. A 50Hz, 3-phase alternator has rated voltage of 13.5kV connected to a circuit breaker, inductive reactance =  $4\Omega/\text{ph}$  capacitance =  $2\pi\text{F}$ . Determine:
  - i) Frequency of oscillation
  - ii) Maximum restriking voltage
  - iii) Maximum RRRV. (06 Marks)
- 3 a. Explain with neat diagram, minimum oil circuit breaker. (08 Marks)
- b. Discuss the properties of sulphur-hexafluoride ( $\text{SF}_6$ ) gas that makes it superior for application in circuit breakers. (06 Marks)
- c. Write a short note on : i) Unit test and ii) Synthetic testing of circuit breaker. (06 Marks)
- 4 a. With a neat diagram, explain the construction and working of vacuum circuit breaker. (08 Marks)
- b. Explain the working principle of the lightning arrester. (06 Marks)
- c. Explain the various causes of over voltage in power system. (06 Marks)

**PART – B**

- 5 a. What is relay? Explain the essential qualities of the relay. (08 Marks)
- b. With a neat diagram, explain the zones of protection in a typical power system. (06 Marks)
- c. Give the detailed classification of protective relays. (06 Marks)
- 6 a. With a neat diagram, explain the operation of induction type non directional over current relay. (08 Marks)
- b. With a neat diagram, explain the working of current differential relay. (06 Marks)
- c. Draw and explain the working of impedance relay and obtain its torque equation. (06 Marks)

- 7 a. Discuss the generator protection schemes against : i) Rotor faults; ii) Abnormal running conditions. (10 Marks)
- b. A synchronous generator rated at 20kV protected by a circulating current system having neutral grounded through a resistance of  $15\Omega$ . The differential protection relay is set to operate when there is an out-of-balance current of 3Amps. The CTs have the ratio of 1000/5 Amps. Determine:
- i) The percentage of winding remains unprotected.
- ii) Value of earth resistance to achieve 75% protection of winding. (10 Marks)
- 8 a. Draw and explain the Buchholz relay for protection of power transformer. (08 Marks)
- b. With the neat circuit diagram, explain how the protection of Induction motor is possible by a single phase preventer. (06 Marks)
- c. List the various abnormal conditions against which a large induction motor has to be protected. (06 Marks)

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